

CLAIM OR CLAIMS

I claim:

- 5 1. A multilayer film or sheet comprising:
- a.) a first co-extruded polymeric layer consisting essentially of ionomer;
 - and
 - b.) at least one co-extruded second polymeric layer selected from the group
- 10 consisting of ionomer, ionomer-polyethylene blend, and ionomer-polyamide blend in contact with said first co-extruded polymeric layer.
2. A multilayer film or sheet of Claim 1 further comprising at least one
- 15 additional co-extruded third polymeric layer in contact with said second co-extruded polymeric layer.
3. A multilayer film or sheet of Claim 1 or 2 wherein said ionomer consisting
- essentially of a copolymer derived from ethylene and α , β -ethenically unsaturated
- 20 C_3 to C_8 carboxylic acid wherein said copolymer is partially neutralized with metal ions.
4. A multilayer film or sheet of Claim 1 or 2 wherein said ionomer-polyamide
- blend consists essentially of one or more polyamide which forms a continuous
- phase or co-continuous phase with one or more ionomer dispersed therein, said
- 25 ionomer is present in the range from 60 to 40 weight percent and said polyamide is present in the range from 40 to 60 weight percent based on the total weight of
- ionomer and polyamide, said ionomer consisting essentially of a copolymer
- derived from ethylene and α , β -ethenically unsaturated C_3 to C_8 carboxylic acid
- wherein said copolymer is partially neutralized with metal ions; wherein the
- 30 average acid content of copolymer prior to neutralization is present in a sufficiently high percentage such that neutralization in the range of 55 to 100 mole

percent of the acid present at melt temperature with one or more metal cations increases the viscosity of the ionomer above that of the polyamide.

5 5. A multilayer film or sheet of Claim 1 or 2 wherein one or more of said co-extruded polymeric layers contain pigments, dyes, flakes, or mixtures thereof.

6. A multilayer film or sheet of Claim 1 or 2 wherein said first co-extruded polymeric layer is clear and said co-extruded second polymeric layer contains pigments, dyes, flakes, or mixtures thereof.

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7. A multilayer film or sheet comprising:

a.) a first co-extruded polymeric layer consisting essentially of ionomer; and

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b.) at least one co-extruded second polymeric layer consisting essentially of very low density polyethylene in contact with said first co-extruded polymeric layer.

8. A multilayer film or sheet of Claim 7 further comprising at least one additional co-extruded third polymeric layer in contact with said second co-extruded polymeric layer.

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9. A multilayer film or sheet of Claim 7 or 8 wherein said ionomer consisting essentially of a copolymer derived from ethylene and α , β -ethenically unsaturated C₃ to C₈ carboxylic acid wherein said copolymer is partially neutralized with metal ions.

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10. A multilayer film or sheet of Claim 7 or 8 wherein one or more of said co-extruded polymeric layers contain pigments, dyes, flakes, or mixtures thereof.

11. A multilayer film or sheet of Claim 7 or 8 wherein said first co-extruded polymeric layer is clear and said co-extruded second polymeric layer contains pigments, dyes, flakes, or mixtures thereof.

5 12. A multilayer film or sheet comprising:

a.) a first co-extruded polymeric layer consisting essentially of ionomer;
and

10 b.) at least one co-extruded second polymeric sheet layer consisting essentially of ethylene polar copolymer in contact with said first co-extruded polymeric layer.

13. A multilayer film or sheet of Claim 12 further comprising at least one additional co-extruded third polymeric layer in contact with said second co-extruded polymeric layer.

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14. A multilayer film or sheet of Claim 12 or 13 wherein said ionomer consisting essentially of a copolymer derived from ethylene and α , β -ethenically unsaturated C_3 to C_8 carboxylic acid wherein said copolymer is partially neutralized with metal ions.

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15. A multilayer film or sheet of Claim 12 or 13 wherein one or more of said co-extruded polymeric layers contain pigments, dyes, flakes, or mixtures thereof.

25 16. A multilayer film or sheet of Claim 12 or 13 wherein said first co-extruded polymeric layer is clear and said co-extruded second polymeric layer contains pigments, dyes, flakes, or mixtures thereof.

17. A multilayer film or sheet comprising:

30 a.) a first co-extrusion polymeric layer consisting essentially of ionomer-polyamide blend; and

b.) at least one additional co-extruded second polymeric layer in contact with said first co-extruded polymeric layer.

18. A multilayer film or sheet of Claim 17 wherein said ionomer-polyamide
5 blend consists essentially of one or more polyamide which forms a continuous phase or co-continuous phase with one or more ionomer dispersed therein, said ionomer is present in the range from 60 to 40 weight percent and said polyamide is present in the range from 40 to 60 weight percent based on the total weight of ionomer and polyamide, said ionomer consisting essentially of a copolymer
10 derived from ethylene and α , β -ethenically unsaturated C_3 to C_8 carboxylic acid wherein said copolymer is partially neutralized with metal ions; wherein the average acid content of copolymer prior to neutralization is present in a sufficiently high percentage such that neutralization in the range of 55 to 100 mole percent of the acid present at melt temperature with one or more metal cations
15 increases the viscosity of the ionomer above that of the polyamide.

19. A multilayer film or sheet of Claim 17 or 18 wherein one or more of said co-extruded polymeric layers contain pigments, dyes, flakes, or mixtures thereof.

20. A multilayer film or sheet of Claim 17 or 18 wherein said first co-extruded polymeric layer contains pigments, dyes, flakes, or mixtures thereof.

21. A multilayer film or sheet of Claim 17 or 18 wherein said second co-extruded polymeric layer is selected from the group consisting of ionomer, ionomer-polyethylene blend, ionomer-polyamide blend, very low density polyethylene,
25 ethylene polar copolymer, and blends thereof.

22. A process for making shaped article having an ionomer or ionomer-polyamide blend as a top surface comprising the steps of:

c.) positioning a monolayer sheet of ionomer or ionomer-polyamide blend or a multilayer co-extruded sheet into a mold, wherein the thickness of said monolayer sheet or said multilayer sheet is from 8 to 60 mils and wherein said multilayer sheet comprises;

5 *i.*) a first co-extruded polymeric layer selected from the group consisting of ionomer and ionomer-polyamide blend; and

ii.) at least one additional co-extruded second polymeric layer in contact with said first co-extruded polymeric layer; and

d.) injection backfilling said monolayer sheet or multilayer co-extruded
10 sheet with a suitable backfilling material.

23. A process according to Claim 22 wherein said multilayer sheet comprises;

(vii) a first co-extruded polymeric layer consisting essentially of ionomer;

15 *(viii)* a second co-extruded polymeric layer selected from the group consisting of ionomer and ionomer-polyamide blend in contact with said first co-extrude polymeric layer; and

(ix) at least one additional co-extruded third polymeric layer in contact with said second co-extrude polymeric layer.

20 24. A process of Claim 22 or 23 wherein said ionomer consisting essentially of a copolymer derived from ethylene and α , β -ethenically unsaturated C_3 to C_8 carboxylic acid wherein said copolymer is partially neutralized with metal ions.

25 25. A process of Claim 22 or 23 wherein said ionomer-polyamide blend consists essentially of one or more polyamide which forms a continuous phase or co-continuous phase with one or more ionomer dispersed therein, said ionomer is present in the range from 60 to 40 weight percent and said polyamide is present in the range from 40 to 60 weight percent based on the total weight of ionomer and
30 polyamide, said ionomer consisting essentially of a copolymer derived from

ethylene and α , β -ethenically unsaturated C_3 to C_8 carboxylic acid wherein said copolymer is partially neutralized with metal ions; wherein the average acid content of copolymer prior to neutralization is present in a sufficiently high percentage such that neutralization in the range of 55 to 100 mole percent of the acid present at melt temperature with one or more metal cations increases the viscosity of the ionomer above that of the polyamide.

26. A process of Claim 23 wherein said first co-extruded polymeric layer is clear and said co-extruded second polymeric layer contains pigments, dyes, flakes, or mixtures thereof.

27. A process of Claim 22, 23, or 26 further comprising the step of thermoforming said multilayer co-extruded sheet prior to positioning said sheet in a mold and injection backfilling.

28. A process of Claim 27 wherein the top surface of said shaped article has a Distinctness of Image (DOI) of at least 80 and a gloss that exceeds 60% at a 20 degree angle.

29. A process of Claim 22, 23 or 26 wherein said suitable backfilling material is selected from the group consisting of thermoplastic polyolefins, polyesters, sheet molding compounds (SMC), acrylonitrile butyl styrene, polyvinyl chloride, polystyrene, polyurethane, low density polyethylene, linear low density polyethylene, high density polyethylene, and mixtures thereof.

30. A process of Claim 22, 23, or 26 wherein said multilayer sheet further comprises one or more co-extruded polymeric tie layers selected from the group consisting of: blends of polyethylene, ethylene/alpha-olefin copolymer, and ethylene elastomer; ethylene vinyl acetate; ethylene (meth)acrylate copolymer; ethylene butyl acrylate copolymer; polyethylene terephthalate and polyethylene

terephthalate glycol copolymer resins; maleic anhydride modified polypropylene; copolymers containing anhydride grafts and mixture thereof.

31. A process of Claim 22 wherein said multilayer sheet comprises co-extruded
 5 polymeric layers selected from the group consisting of: ionomer monolayer (clear or pigmented);
 ionomer-polyamide blend monolayer (pigmented);
 ionomer (clear) / polyethylene-ionomer blend (pigmented);
 ionomer (clear) / polyethylene-elastomer blend (pigmented); ionomer
 10 (clear) / ionomer (pigmented) / ethylene copolymer;
 ionomer (clear) / ionomer (pigmented) / very low density polyethylene;
 ionomer (clear) / ethylene acid copolymer (pigmented) / very low density polyethylene (pigmented);
 ionomer (clear) / ethylene acid copolymer (pigmented) / very low density
 15 polyethylene / olefinic thermoplastic;
 ionomer (pigmented) / ionomer (pigmented) / ethylene acid copolymer;
 ionomer (pigmented) / ethylene acid copolymer;
 ionomer (pigmented) / terpolymer ethylene-acid-acrylate (pigmented) / olefinic thermoplastic;
 20 ionomer (pigmented) / terpolymer ethylene-acrylate-glycidal methacrylate (pigmented) / olefinic thermoplastic;
 ionomer (clear) / terpolymer ethylene-acid-acrylate (pigmented) / olefinic thermoplastic;
 ionomer (clear) / terpolymer ethylene-acrylate-glycidal methacrylate (pigmented) /
 25 olefinic thermoplastic;
 ionomer (clear) / ionomer (pigmented) / terpolymer ethylene-acrylate-glycidal methacrylate / olefinic thermoplastic;
 ionomer (clear) / ethylene-acrylate copolymer (pigmented) / ethylene copolymer;
 ionomer (clear) / ionomer (pigmented) / ethylene copolymer / polyethylene;
 30 ionomer (clear) / ionomer (pigmented) / ethylene copolymer / polyester copolymer;

ionomer (clear) / ionomer (pigmented) / polyamide (pigmented);

ionomer (clear) / ionomer (pigmented) / tie layer (pigmented) / thermoplastic polyolefin;

ionomer (clear) / ionomer (pigmented) / tie layer / thermoplastic polyolefin

5 (pigmented);

ionomer (clear) / ionomer (pigmented) / polyethylene-ionomer blend;

ionomer (clear) / ionomer (pigmented) / tie / nitrile copolymer;

ionomer-polyamide blend / tie / thermoplastic polyolefin;

ionomer-polyamide blend / tie / polyester copolymer;

10 ionomer-polyamide blend / tie / nitrile copolymer;

ionomer-polyamide blend / polyamide copolymer;

ionomer (clear) / ionomer (pigmented) / tie layer / thermoplastic polyolefin;

ionomer / ionomer (pigmented) / tie layer / polyester copolymer;

ionomer / ionomer (pigmented) / tie layer / polyester copolymer,

15 ionomer / polyamide (pigmented) / tie layer / polyester,

ionomer / polyamide (pigmented) / tie layer / recycle / polyester copolymer; and

ionomer / ionomer (pigmented) / tie layer / recycle / tie layer / polyester copolymer.

20 32. A process of Claim 22, 23, or 26 wherein said multilayer sheet further comprises one or more additional co-extruded polymeric layers containing recycled polymer.

33. A process for making a thermoformed, multilayer, sheet-surfaced article comprising the steps of:

25 c.) positioning a multilayer sheet into a mold, wherein the thickness of said multilayer sheet is from 8 to 60 mils and wherein said multilayer sheet comprises;

i.) a first co-extruded polymeric layer selected from the group consisting of ionomer and ionomer-polyamide blend; and

ii.) at least one additional co-extruded second polymeric layer in contact with said first co-extrude polymeric layer; and

b.) raising the temperature of said sheet sufficiently to soften said multilayer sheet; and

c.) conforming said softened sheet to the contoured surface of a substrate in the mold.

34. A process according to Claim 33 wherein said multilayer sheet comprises;

(*x*) a first co-extruded polymeric layer consisting essentially of ionomer;

(*xi*) a second co-extruded polymeric layer selected from the group consisting of ionomer and ionomer-polyamide blend in contact with said first co-extruded polymeric layer; and

(*xii*) at least one additional co-extruded third polymeric layer in contact with said second co-extrude polymeric layer.

35. A process of Claim 33 or 34 wherein said multilayer sheet is pre-heated to soften said sheet prior to positioning into a mold.

36. The process of Claim 35 wherein the mold has a deep draw.

37. The process of Claim 33 or 34 wherein the conforming of step (c) is at a sufficient pressure within the mold to form an article wherein the surface layer of said article closely replicates the surface finish of the mold.

38. The process of Claim 37 wherein the mold is highly polished so as to provide a high gloss surface attribute on said article.

39. The process of Claim 37 wherein the mold is textured so as to provide a textured surface on said article.

40. The process of Claim 35 wherein the conforming of step (c) is at a sufficient pressure within the mold to form an article wherein the surface layer of said article closely replicates the surface finish of the mold.

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41. The process of Claim 40 wherein the mold is highly polished so as to provide a high gloss surface attribute on said article.

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42. The process of Claim 40 wherein the mold is textured so as to provide a textured surface on said article.

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43. An article consisting essentially of a substrate to which a multilayer film or sheet is adhered, wherein said multilayer film or sheet comprises:

- a.) a first co-extruded polymeric layer consisting essentially of ionomer;
- and
- b.) at least one co-extruded second polymeric layer selected from the group consisting of ionomer, ionomer-polyethylene blend, and ionomer-polyamide blend in contact with said first co-extruded polymeric layer.

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44. A article of Claim 43 wherein said multilayer film or sheet further comprises at least one additional co-extruded third polymeric layer in contact with said second co-extruded polymeric layer.

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45. An article consisting essentially of a substrate to which a multilayer film or sheet is adhered, wherein said multilayer film or sheet comprises:

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- a.) a first co-extruded polymeric layer consisting essentially of ionomer;
- and
- b.) at least one co-extruded second polymeric layer consisting essentially of very low density polyethylene in contact with said first co-extruded polymeric layer.

46. A article of Claim 45 wherein said multilayer film or sheet further comprises at least one additional co-extruded third polymeric layer in contact with said second co-extruded polymeric layer.

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47. An article consisting essentially of a substrate to which a multilayer film or sheet is adhered, wherein said multilayer film or sheet comprises:

a.) a first co-extruded polymeric layer consisting essentially of ionomer;
and

b.) at least one co-extruded second polymeric sheet layer consisting essentially of ethylene polar copolymer in contact with said first co-extruded polymeric layer.

48. A article of Claim 47 wherein said multilayer film or sheet further comprises at least one additional co-extruded third polymeric layer in contact with said second co-extruded polymeric layer.

49. An article consisting essentially of a substrate to which a multilayer film or sheet is adhered, wherein said multilayer film or sheet comprises:

a.) a first co-extrusion polymeric layer consisting essentially of ionomer-polyamide blend; and

b.) at least one additional co-extruded second polymeric layer in contact with said first co-extrude polymeric layer.

50. A article of Claim 49 wherein said multilayer film or sheet further comprises at least one additional co-extruded third polymeric layer in contact with said second co-extruded polymeric layer.

51. An article in any of Claims 43 - 50 wherein the substrate is selected from the group consisting of metal, polymer, and polymer composite.

52. An article in any of Claims 43 - 50 wherein the substrate has a printed design or pattern and said multilayer film or sheet is clear.

5 53. An article in any of Claims 43 - 50 wherein one or more of said co-extruded polymeric layers contain pigments, dyes, flakes, or mixtures thereof.